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THE DAIRY HERD: ITS FORMATION AND MANAGEMENT.

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U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ANIMAL INDUSTRY,
Washington, D. C., January 6, 1904.

SIR: I have the honor to transmit herewith copy for a revised edition of Farmers' Bulletin No. 55, *The Dairy Herd: Its Formation and Management*, by Henry E. Alvord, Chief of the Dairy Division of this Bureau. This article originally appeared in the Yearbook of the Department of Agriculture for 1894, and was reprinted with revision by the author as a Farmers' Bulletin in April, 1897. There is considerable demand for the bulletin, and it is believed that in its present revised form it will be still more valuable for distribution.

Respectfully,

D. E. SALMON,
Chief of Bureau.

Hon. JAMES WILSON, *Secretary.*



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THE DAIRY HERD: ITS FORMATION AND MANAGEMENT.

INTRODUCTION.

The pursuit of dairy farming depends for its success upon certain fundamental conditions. First, the owner of the business himself, or otherwise the agent or manager who has the immediate control and personal direction of the work, must have a natural fondness for animals, prompting to generous and kind treatment, as well as good judgment in selection, breeding, and care. It is not sufficient that he should be a horseman, or fond of cattle in general; for best results he should have a special liking for the dairy cow, over and above all other animals. Second, the cattle must be good of their kind and of a variety suited to the work. They must be truly dairy cattle; but of this more presently. Third, the farm should be specially adapted to the branch of husbandry in view. A good dairy farm is pretty certain to be good for general farming, but many good farms in general are not suited to dairying. The dairy farm should be carefully selected, all the requirements of the business being well considered. Yet many disadvantages so far as the farm is concerned may be successfully overcome by the skillful dairyman, and dairying in some form is profitably conducted without any farm, so that this condition, important as it is, can not be regarded as essential. Fourth, it is well to study the character of the accessible markets and the means of communication; location and the line of dairying to be followed may be largely controlled by the markets. In some cases the markets form an essential condition, but modern facilities for transportation make the location of the dairy farm with relation to its markets comparatively unimportant. The first and second of the above qualifications remain as the essential factors—the owner and the cow. Assuming that the dairyman is all he should be, it is proposed to consider in the following pages the dairyman's main stock in trade, upon which depends his success—the dairy herd, its formation and management.

Like almost all other occupations at the present day, dairying has become divided into several distinct and special lines. These differ mainly as to the form of product and the manner of disposing of it. Milk or cream may be produced for delivery to consumers, and this

delivery may be direct or indirect. The same products may be delivered to a factory for manufacture into butter or cheese, or the milk product of the herd may be worked up at home and there converted into butter or cheese. The prudent dairyman should first consider which line of business he will pursue. In so doing he must have regard for all his circumstances—the location, markets, farm, buildings, water and ice supply, the labor at his command—and his own preference, and prospects for profit. Upon his decision as to the particular kind of dairying to be followed should depend the character and composition of his herd of cattle.

CATTLE FOR THE DAIRY.

Dairymen are divided in opinion as to the kind of cow which is most profitable. Some prefer a “general-purpose cow,” which is a member of a specially developed milk-producing family from one of the beef breeds, or grades of such stock. An animal is thus secured which has a large frame, is easily kept in good flesh, and fattens soon when not milking heavily; such an one also has large calves, profitable for veal or for growing as steers. Even if such animals are not so productive while in the dairy, their meat-making proclivities may make up for it. There are two or three of the established breeds of cattle which claim to possess combined qualities for meat and milk. On the other hand, many dairymen (including the writer) prefer cattle of the distinct class or type especially adapted to dairy purposes alone. This class includes various families and breeds, all having the marked characteristics which distinguish the milk producer. Owners of such cows expect them to be so profitable as milkers that their beef-producing quality and the final disposition of their carcasses may be entirely ignored; and the calves, except so far as wanted to raise for the dairy, are given little consideration. Which of these lines of policy should be pursued every dairyman must determine for himself. To succeed in his business he should select his herd or its foundation with a view to profit. Whether he should buy, breed, and feed his cows, having in view only their dairy products and capacity for reproduction, or whether he will find it more profitable to include the items of beef and veal, must be largely determined by home conditions.

SPECIAL ADAPTATION.

Within the general class of dairy cattle one can find great variety and can therefore select breeds or families well adapted to the special needs in view. Some dairy cattle are noted for the quantity of milk they produce; others for the high quality or richness of their milk, which means they are good butter producers. Some combine quantity and quality in a specially economical way, under some circumstances.

There are cows of active habits, which forage well on a wide range of scanty pasture, and will profitably work up the coarser kinds of food in winter. There are others which have proved their capacity for making good returns when more closely confined and subjected to high feeding. Some cows give a great flow of milk for a comparatively short season, and others are noted for an even, steady yield of milk the year through. The dairyman can easily find cattle, therefore, adapted to his particular wants. As a rule, the different dairy characteristics named pertain to different breeds, so that every dairyman is likely to find some one breed of dairy cattle better suited to his wants than any other.

This is not the place to revive the never-ended "battle of the breeds." No matter how strong one's convictions, discretion must be exercised. Pronounced opinions and direct advice as to the several recognized dairy breeds are here unnecessary. Evidence abounds on every side, and every dairyman, or prospective dairyman, can satisfy himself as to the cattle he should adopt, if he will but make a proper study of the subject. He need not go far in this country to find the best kind or breed of cows for milk supply, the best for butter making, or the best for the cream trade. There is no special cheese-making cow; the best butter cow is also the best for cheese; this fact has been demonstrated beyond dispute.

FORMATION OF THE DAIRY HERD.

There are two very different ways of forming a dairy herd and of maintaining its size and quality. It may be done by buying or by breeding, and these two methods may be combined.

By purchase.—The purchasing plan is practiced to a considerable extent by those who produce milk for town and city supply. In a few cases it has been known to be successful where the work of the herd was to make butter. Applied in its extreme form, cows are bought when mature and at their prime, judged almost exclusively by their milk yield, are highly fed so as to keep steadily gaining in flesh, and are sold, usually to the butcher, as soon as they cease to be profitable as milkers. The bull may be of any kind so long as he gets the cows in calf, as the calves are of value only as causing "fresh" cows and are disposed of as soon as possible. The first modification of this system is to keep extra good cows for several seasons and the next to raise heifers from some of the best milkers to replenish the herd. This way of making up a herd and keeping good its numbers requires abundant capital and rare judgment in buying and in selling. It can not be recommended to one lacking experience, and even the shrewdest buyer runs great risk of bringing disease into his herd.

By breeding.—The other extreme is to begin with a few well-selected animals as a foundation, and gradually build up the herd to the size

desired by judicious breeding and natural increase. This method takes time, and time which may be money, but it is by far the safer and more satisfactory in its results, and it must be recognized as a higher grade of dairy farming.

Foundation of the herd.—A desirable combination in starting is to buy the number of cows desired and good animals of the sort determined in advance. If one's means will permit, include a few superior cows and a first-class bull at any rate. Let the cows selected be such as have had two calves, and perhaps three, so that they may be judged by their own development and yet be young enough to improve and be in full profit for some years. With a herd thus formed, begin at once the work of improvement by breeding and selection. Sell promptly any cow which proves unsatisfactory and replace her by the best increase of the herd, or purchase occasionally an animal which will raise the average quality.

PUREBRED DAIRY CATTLE AND GRADES.

Quality of stock.—A dairyman can hardly be advised to buy at once a full stock of purebred cattle of any breed, if his sole object and dependence for profit is to be the dairy product of the herd. Such a venture will necessitate large investment, and should include the breeding of registered animals, for sale at remunerative prices, as a part of the business. Well-bred and well-selected grade cows of the line of blood desired seem to be the most profitable animals for the practical dairyman, or at least the best to begin with. If enterprising and progressive, the owner will hardly be content with grades only. He may begin with only his bull pure bred; presently he will want a registered cow to match, then one or two more. Thus he will be steadily and properly working toward a purely-bred herd. If the breed chosen is the right one for the object sought, it will soon be found that the more of this blood the herd contains the better. Starting with half-bred cows (the offspring of pure-bred bulls and dams of mixed or uncertain blood), the next grade, three-fourths pure, will prove better dairy stock, if the bull is what he should be and the increase has been culled. Another step higher is better still, better for the dairy, and so the grading goes up and improvement goes on until the blood of the herd is practically pure. The best dairy results may thus be reached, but the herd has a taint. It lacks pedigree. Its increase, however excellent in dairy performance, must pass and sell as grades. The owner feels this, and is pretty sure to gradually replace his well-bred cows, almost pure bred, with fully pedigreed and registered animals. This end is reached sooner and easier by starting with one or two registered females, and, of course, a registered bull. Moderate investment and the lessened risk of loss in the

hands of one unaccustomed to handling registered stock, and finding a market for the surplus, doubtless favor grades for the dairy herd. The argument and the probabilities of success, based upon the fixed principles of breeding, are on the side of purebred registered stock. In the hands of experienced men the latter prove the more profitable in actual practice.

Buying registered cattle.—In these days any dairyman who wants registered animals of any of the approved breeds can get them if he will but make the effort. The beginner in registered dairy stock can not be too strongly urged to buy and breed on the basis of individual and family merit and dairy record, and not upon pedigree alone. Pedigree is of value and should be well studied; it is the best guaranty that the calves to come will make good cows. But the pedigree should be supported by uniform excellence in the family and by evidence of merit in the particular animals bought. Although the investment is greater, there is greater certainty of good results if mature cows are bought which show what can be expected of them, if they have not already made a record, than if calves or undeveloped heifers are selected. It is also economy, having chosen the right breed, to purchase good representatives of that breed, rather than be content with only average or even ordinary animals. Successful dairying has proved that the greater profit comes from the best cows, whatever their kind. This is as true of purebred or registered stock as of common cows. It is better to pay \$300 for three excellent cows than to pay the same sum for four good cows or five which are only fair. A really superior dairy cow of a superior family, with pedigree which gives assurance of calves equal to the dam, if not better, is always worth a large price. Such an animal adds much to the average value of any dairy herd. In buying registered cattle deal only with men of reputation as breeders and of strict integrity. "The best part of a pedigree is the name of the breeder."

THE BULL AND HIS TREATMENT.

Selection of the bull.—With any dairyman who depends upon breeding and rearing calves for the maintenance of his herd and its improvement, the choice of a bull is a matter of prime importance. The bull is constantly referred to as "the head" of the herd, and that trite saying, "The bull is half the herd," should never be forgotten. Every calf added to the herd takes half its blood from the bull. Often this is the more important half. The bull is always the main dependence for raising the average quality of the herd, and should be chosen with this object in view. This is especially true if the cows are grades and "grading up" is in progress. The grade dam may be selected and largely relied upon to give size, form, constitution, and capacity

of production to her heifer calf; its dairy quality, the inbred power to increase the richness of milk, is derived from the purebred sire. One cow may prove a poor dam, or fail to breed, and still give a profit in milk. Such a loss is comparatively trivial and the fault easily corrected. But if the bull fails, or proves a poor sire, the entire increase of a year may be lost. In getting a bull, get the best; or at least approach that standard as nearly as possible. Make a study of the animal's pedigree and the dairy history of his ancestors, and especially of the females among his nearest of kin. Then see that the good qualities of his progenitors appear to be reproduced in the animal in question. A common error among dairymen is to use immature bulls and to dispose of good ones before their merit as sires has been fairly proven. Bull calves are cheap, and young bulls are considered much easier to handle. But it is good advice to the buyer to purchase a bull of some age, whose progeny prove his value as a breeder, rather than a calf of exceptional pedigree; and to the owner, having a sire of proved excellence, to keep him and use him for years, or as long as he shows himself potent and prepotent. (Of course the question of too close inbreeding is not forgotten and must not be overlooked by the breeder.) The writer is a thorough believer in the use of mature bulls of known value as sires.

Temperament.—The chief objection made to bulls of some age is that they are likely to be vicious and dangerous. Everyone recognizes the difference in temperament between the fleshy, beefy bull and the one of pronounced dairy character; but experience and observation have taught that the bulls of marked dairy type are much alike in disposition, regardless of breed. In all the breeds (as among men) some bulls will be found of naturally bad temper, but it is believed that the great majority of bulls of all the dairy breeds can be safely kept until too old for service and handled without serious trouble, if only properly reared and judiciously managed.

Control and exercise.—In rearing a bull, accustom it to being handled from calfhood, but without fondling or encouraging frolic. Give it kind, quiet, firm, and unvarying treatment, and keep it always under subjection, that it may never know its strength and power. Insert the nose ring before it is a year old, keep this renewed so as to be always strong, and always lead and handle the animal with staff in the hands of a discreet and trusty man. The bull should never run loose in yard or pasture, but should be provided with abundant and regular exercise, always under restraint and full control. The "walk around" arrangement, like the sweep horsepower, affords a fair degree of voluntary exercise, but is hardly sufficient. The best plan seems to be to provide a suitable tread power with a governor attached, place the bull in this daily, and let him walk a fixed time or known distance.

The main object should be regular and sufficient exercise for the bull. Incidentally, he may be made to run a fodder cutter or a cream separator and perform valuable service. As age and strength increase, let the staff be supplemented by strap, chain, or rope attached to a second ring. To this may well be added some hitching or leading chain with a strong strap around horns or neck. Let there be always a double hitching device, so that the bull may never by accident find himself loose when he should be tied. If restiveness and temper are shown, add to the exercise, in duration or quantity, without violence; a bull physically tired may be depended upon to be quiet and easily managed.

It is much better to keep the bull as much as possible in the presence or in full sight of the herd than stabled by himself in a lonely place. Let him be in the same room with the cows during the stabling season, and at milking times the rest of the year.

INDIVIDUALITY AND CULLING THE HERD BY ITS RECORD.

Keeping records.—As soon as the herd is established and in working order, the study of every individual animal should begin. To guide rational treatment and insure greatest profit, the owner must become familiar with the characteristics of every cow. Peculiarities of temperament, susceptibility to surroundings and varied conditions, and especially the dairy capacity of the animal, should be matters of observation, deliberation, and record, not merely of conjecture and memory. The record of the herd is a matter of utmost importance. The system of record should conform to the circumstances of the case and extent of the business. (It is desirable to reduce the labor of bookkeeping to a minimum, and yet accuracy and sufficiency of record must be secured. Fortunately, inexpensive forms can now be found for sale, which are based upon long experience, and in variety to suit different wants.) The record should include a concise history and description of every member of the herd, with a summary of the dairy performance. The latter requires a daily record of the milk yield of every cow, with notes explaining irregularities or occurrences of interest. If the quality of the milk is a matter of any importance, as it is in most cases, and ought to be, however the milk is disposed of, a fat test should be made of the milk of every cow, for several consecutive milkings, as often as practicable. Some form of the Babcock tester is the simplest, and now within the reach of every dairyman. According to the size of the apparatus, a certain number of milk samples can be tested at one time, and thus the record of a large herd can be completed in a few days. It is well to make this test and record of the quality of every cow's milk at least once a month. The most satisfactory practical record is the average percentage of fat found in the

milk of several successive milkings, samples from which may be mixed and this "composite sample" tested, thus obtaining the average; the method is easily learned and practiced. This record of quality, taken periodically, joined with a summary of the daily quantity of milk, gives a full dairy record of the cow, upon which her value can be readily computed. To give the owner a more complete knowledge of his operations, there should also be a record, of at least approximate accuracy, of the food of every cow, with monthly summaries of quantities or value, so that the economy of production may be shown.

Value of records.—Such records are far more easily made than the description may indicate, and are well worth all they cost. They form the only accurate and safe basis for judging the individual merits of the different animals. The improvement of every herd, which should be the constant aim of its owner, depends upon periodical culling and getting rid of unworthy members. No one can afford to do this upon guesswork alone. One well-authenticated example of the value of keeping such record follows: A dairyman of wide reputation, president of a State association for years, concluded to adopt the daily milk record, rather because of those who advocated it than of any conviction of needing it himself. His herd was of his own breeding; he had handled every cow from its birth, and he and his sons did the milking. Before beginning the record he made note of the joint opinion of himself and sons as to the half dozen best cows in the herd and an estimate of their season's milk yield. When the year's record was completed it was found that in order of actual merit the cows actually stood thus: First, his fifth; second, a cow not on his merit list; third, his fourth; fourth, his first; fifth, his sixth; sixth, like the second; and his second and third still lower on the list. These facts were verified by subsequent records. Still more remarkable, this experienced owner proved literally "by the book" that about one-fourth of his cows were being kept at an actual loss, while others barely paid their way.

Raising the standard.—Good judges believe that in the entire country one-fourth of the cows kept for their milk do not pay for their cost of keeping, and nearly a fourth more fail to yield annual profit. As a matter of ordinary business prudence and a condition essential to best results, every dairyman should study the individuality of his cows, keep a sufficient record of quantity and quality of milk product, know approximately the cost of production, and systematically weed out his herd. After proper consideration and practical tests as to possibilities, set a standard for a satisfactory cow and maintain this standard by promptly disposing of the animals which fail to attain it, unless reasonable excuse appears, with the prospect of better conduct in future, and gradually but persistently raise the standard.

ACCOMMODATIONS FOR THE HERD.

Stabling.—The large and lofty barn, in which to keep the cattle and the crops, the manure and farm implements, all within four rectangular walls and under one roof, can no longer be regarded as perfection. No matter how well arranged and how thorough the ventilation, the danger of loss and damage is too great. It is well to house all the forage, and a large storage building may be necessary. Economy of labor requires the forage to be easily placed before the cattle. The best modern practice calls for a separate or slightly attached building for the cows, with no manure cellar under them and no large quantity of forage above them, and preferably none at all. The best provision for such manure as can not be at once applied to the land is an open shed or covered yard. The cow-house should be on the ground level, rather than in a basement, and be light, dry, and roomy. A room open to the roof, which is fairly high, is better than a low, level ceiling above the cows. The former may involve a little more work to keep free from dust and cobwebs, but it affords the air space needed for health and comfort. The latter necessitates special arrangement for ventilation, and this, constructed on the best plans, often fails to work in practice. Sanitary authorities advise 600 cubic feet of space for every animal, but the best cow house the writer has seen allows double this quantity, and it appears none too much. Where the climate will permit, there is no better plan than to let cows stand upon the ground, the clay or earth being packed hard and raised somewhat above the level around the building; shallow gutters behind the cows and a feeding floor in front of them. More durable floors, and quite expensive, are made of grouting and cement, or of brick on edge; but such are often damp and cold, causing rheumatism and other ailments, unless covered with a false floor of wood or provided with an unusual abundance of bedding. Box stalls are undoubtedly the ideal for cows as well as for horses; in a box 8 to 10 feet square a cow may be left untied, and if supplied with enough bedding she will keep clean and well, although the stall is not cleaned out for months at a time. But such boxes for a large herd require too much room. Every cow should have her own stall, however, wide enough for comfort of cow and milker, and well protected from the neighbors on either side; $3\frac{1}{2}$ feet width is little enough and 4 feet is better.

Ties.—From the great variety of cattle ties one should be selected which combines, in greatest measure, freedom of movement, comfort, and cleanliness. There are serious objections to all stanchions; if some form of this device is insisted upon, let it be one which is so hung as to move a few inches in any direction. A desirable substitute for a stanchion is a wide strap or light chain around the neck, with a ring at the throat (this part to be always worn by the cow), and a snap,

with a few links of chain, attached to an iron ring which moves freely upon a 3 or 4 inch post, fastened upright at the middle of the side of the feed box next to the cow. An excellent patented device consists of a flattened bow of metal or wood, shaped like a widely spread letter U, the ends hinged at the front corners of the feed box, the bow resting on the back edge of the box, and the neck strap fastened to this bow at its middle; this gives much freedom of movement and causes the animal to move backward a little when it lies down and forward when it rises.

Floor.—An open, level feeding floor in front of the cows seems to be better than any form of boxes; if boxes are used, they should be as large as possible and yet have every part within reach of the cow as tied, and they should be so constructed as to be easily cleaned. A manure gutter behind the animals aids in cleanliness, but while it should have good width—16 to 24 inches—it should not be too deep; if enough to hold the droppings of a night, that is sufficient. “Self-cleaning” stalls and gutters have not proved successful.

Length and care of stall.—The length of stall from fastening to gutter should suit the size of the cow; it is bad practice to have them so long as to induce filthy udders and legs, and also to have them so short that cows stand habitually with hind feet in the gutter. Arrangements should be convenient for removing the manure and for supplying absorbents for the urine, and a part of the bedding. Liberal use of land plaster about the gutters and the floors over which the cattle pass is very desirable as a disinfectant and conservator of ammonia. Lime should be used with equal freedom as whitewash on the walls of the cow house, but not on its floors.

Light and air.—The stable should be provided with windows to admit light and air abundantly, and arranged to let sunlight as nearly as possible into every portion of the apartment where the cows stand during some hour of every clear day. Yet the windows should be shaded when desired, and they should be fixed to open partly without subjecting the cows to direct drafts of air.

Water.—The extremes in providing water for the cows are to be avoided. A long walk to get water, in all weather, is certainly objectionable. And all the devices for keeping water constantly before every cow, or supplying it at the stalls, at will, are open to serious objections. Some medium course is advised, and the best plan seems to be to provide one or more tanks in the yard and one or more in the stable, at each of which but one cow should drink at a time. These should fill quickly after use and freely overflow, that every cow may find the surface fresh and clear. The evidence is conclusive that water for milking cows should not be too cold, and that it is profitable to bring water in severely cold weather to a temperature of about

50° F., if it can be cheaply done. Warming to blood heat has not been found advantageous.

Exercise yard.—Attached to the cow house should be an exercise yard for the daily use of cows during the stabling season. Roomy, open sheds should form a part of this inclosure, and the whole may well be roofed over, if arranged for the free circulation of air and for admitting sunshine to a large share of it, while excluding wind and storm.

HEALTH OF THE HERD.

Desirable conditions.—There is no point of greater importance in selecting animals for the foundation of a herd, or in making purchases or additions, than to get perfectly healthy stock. Animals chosen should be critically examined and should afford evidence of being strong in constitution and of healthful vigor. It is advised that all be tuberculin-tested and this, of course, should be done by a competent veterinarian. Besides the robust character of the individuals, the breeding stock from which they are descended, and the herd, stables, and farm from which they come, should be closely examined, on the score of health. Breeding and rearing the animals needed to replenish and increase the herd, and refusing to allow strange animals on the farm, are the best safeguards against the introduction of disease. If purchases must be made, let the new stock be strictly quarantined for at least one month before mingling with the herd. On every farm of any size a well-secluded building for a stock quarantine and hospital, suitably arranged and equipped, is a most useful adjunct. This is not needed for calving cows, or for cases of lameness or ordinary accident, but for cases of acute sickness, retention of afterbirth, abortion, or any symptoms of contagious disease, it is essential. Of course, the building itself, its care, and the attendance upon its occupants must be subjected to regulations suited to any hospital or quarantine.

Accident and sickness.—There are many of the ordinary accidents and ailments to which domestic animals are subject which can be managed by an intelligent owner, or under his direction, without professional assistance. "Every man his own cattle doctor" is a very delusive title; one may well follow this suggestion within reasonable limits, but there is always a point hard to define at which professional aid should be promptly summoned. So long as an owner is certain as to the difficulty, and has knowledge and experience as to treatment or remedy, he may depend upon home resources. But in a case of obscurity, uncertainty, or complications, the owner of a good cow disregards his own interests and his moral obligations if he fails to summon a veterinarian, as much as if he neglected to secure proper medical service for a sick child. And the veterinarian should be selected with the same care one exercises in choosing a family physician.

Environment.—Close confinement, with impure air and lack of exercise, is as prejudicial to the health of milch cows as to that of human beings. Some recently promulgated theories of dark, warm stables and no exercise for profitable milk production are without rational basis and certain to lead to disastrous results sooner or later. Exposure to storms and cold is equally injurious to the health and profit of cows. A judicious mean is the provision for moderate exercise in the open air and sunshine, and the application of the same common-sense care for the comfort of cows which one would approve for members of his own household.

Watchfulness.—Every member of the herd, young or old, should pass under the critical eye of the owner or his trusty assistant daily, and preferably twice a day. The least symptoms of disorder, like dullness, loss of appetite, rough coat, and irregularity of milk, manure, or urine, should be noted and promptly receive the attention which it deserves. Experience is needed on the part of the caretaker to detect and correct the beginnings of trouble, and thus maintain the general health of the herd.

FALL-FRESH COWS MOST PROFITABLE.

Much has been written upon the best season for cows to drop their calves. Opinions still differ, and by far the greater number of milch cows are allowed to follow the most natural course, and either by indifference or intention they "come in" in the spring. The producer of milk for sale, if he has an even trade, may want to have about an equal number of fresh cows every month in the year. If the bull is kept up and service controlled, this can be regulated as a rule, although unpleasant irregularities in breeding will sometimes occur and stubbornly resist correction. But if the prime object is to produce the greatest quantity of milk of the best quality and at the greatest profit from any given number of cows within a year, the evidence is overwhelming that the cows should be managed so as to calve in the autumn months. For like reasons, September is the best month, in most parts of the country, for a heifer to drop her first calf in order to best develop as a cow, and this almost regardless of the age of the animal at first calving. Calves born in the fall are easier reared and make better cows than those born in the spring or summer. It seems needless to rehearse the stock arguments on this subject, based upon the long experience of successful dairymen, but a brief recapitulation may be useful. The cow or heifer calving in the fall needs the most healthy and nutritious pasturage just following the strain and while coming into full flow. Just at the time when some falling off is likely to occur, the animal is brought to the stable and receives good care; the winter feeding and the returns from it may be depended

upon to exceed the midsummer results for any like period. At the stage of milking and of gestation, when another dropping off in the milk yield may be looked for, the fresh pasturage induces a fresh flow, lengthens the milking season, and increases the year's total product. December and January are good months in which to control and supervise the service of the bull. Midsummer and the dogdays are a good time for the cow to be dry and preparing to calve again, and a most unprofitable and annoying time to make milk or handle it. With fall-fresh cows the greatest product and the richest comes at the season when milk and butter are always comparatively high in price. In actual practice four fall-fresh cows have been found to equal five which calved in the spring, in twelve months' product, and at about four-fifths the cost.

DRYING OFF COWS AND CALVING TIME.

When and how to dry off.—It is not unusual to find a cow which shows no inclination to dry off at any time after dropping her first or second calf. Such an animal shows an excellent dairy trait—persistence in the milking habit—but it is doubtful if continuous milking is profitable. Better results are believed to be obtained from cows which are inclined to take an annual rest, if not too long. A month is long enough; three weeks will do in most cases, and six weeks should be the longest time encouraged or allowed for a cow to be dry before calving. An accurate record of service by the bull is essential to preparations for drying off cows at the right time. A table should be kept of the dates when the cows of the herd are successively due to calve, with notes as to the milking habit of every one. When the time comes for drying off a cow the grain food should be gradually withdrawn. This may of itself cause milk to cease forming. If not, omit one milking a day, then milk but once in two days, and thus extend the drying period over two weeks. The udder must be watched, and if any hardening or unnatural heat is shown regular milking must be resumed. If a cow continues to secrete milk it must be drawn. No cow should be forced to “go dry” against manifestly natural resistance to so doing. On the other hand, if an unpleasantly pungent or “smoky” taste appears in a cow's milk she may as well be dried at once, regardless of dates, as her milk will not be good until she is fresh again.

Care of dry cows.—The dry cow may be kept on pasture alone, not too luxuriant, or on a low stable diet, mainly of coarse forage, until about two weeks before calving. Yet the ration, while comparatively “wide,” should be nutritious, and it should include a share of succulent food—roots or silage. Then a slow but steady increase of feeding may proceed, of a nourishing, cool, and laxative kind, so as to become narrower in ratio. Wheat bran is a good material to use at this time,

but new-process linseed meal is better. Experience has led the writer to endeavor to have his cows calve on an upgrade, as it were, while daily gaining in strength and vigor, on a judiciously prepared, nourishing diet, but without high feeding or plethora. A week before calving remove the cow to a roomy, comfortable, quiet box stall, preferably within hearing of the herd, if not in sight. Be sure the bowels are quite loose and moving freely for two days before calving. Watch for the event, but do not disturb the cow or interfere unless something goes wrong or assistance is manifestly necessary.

ABORTION AND MILK FEVER.

Abortion.—In the best-regulated and cared-for herds there will occasionally occur a physical accident or some sudden fright which causes a cow to prematurely drop her calf. The herd should be constantly watched for symptoms of abortion, which will generally be recognized by the experienced herdsman. Should such symptoms appear the suspect should be immediately removed to hospital until the case is over or the signs disappear. In case abortion occurs in stable, yard, or pasture, despite precautions, and wholly without warning, as is sometimes the case, take the animal to hospital at once and use every exertion to thoroughly clean and disinfect the place where the accident occurred. The aborted cow should be carefully nursed and the genital organs freely dressed with antiseptic solutions. The animal should not return to the herd until fully cured, clean, and free from all vaginal discharges. Be on guard for a second case following the first in a few days or within three weeks; if a month elapses recurrence is not to be expected. Veterinarians recognize two distinct kinds of abortion, viz, the *sporadic*, which is the first mentioned above, as resulting from accident, physical injury or fright, from disease of the uterus, or from “sympathetic” influences; and the *epizootic* or *contagious*, which is undoubtedly a germ disease, communicated from animal to animal by the germ and caused only by contagion. There is still much uncertainty about this dread disease and its prevention.

Milk fever.^a—Milk fever, “dropping,” or parturient apoplexy is another scourge of the dairy, twin to abortion. It is an affection which comes without warning, attacks the deepest and richest milkers, is sudden in attack, rapid in progress, and generally fatal. The symptoms are a chill, twitching of the head muscles, failure to eat, chew the cud, or pass manure; distended udder without milk, insensibility of the hind quarters when pinched or pricked; later the cow becomes unsteady on her hind legs, and presently drops. Good cows should be carefully watched for forty-eight hours after calving, and if such warnings appear a veterinarian can not be called too soon. Preventive measures form the best assurance of the owner against losses from

^a For recent important information regarding a “simple and successful treatment” of this disease, see Farmers’ Bulletin No. 206.

this cause. The cow should have abundant exercise up to the week before calving, and then quiet and good care, with daily grooming and active rubbing. Keep the bowels active with proper food, or purgatives if necessary. Insure comfort, guard against cold, and endeavor to maintain active circulation on the surface of the body. A strong dose of physic and brisk grooming may be used immediately after calving in the case of cows believed to be predisposed to milk fever.

CARE OF CALVES AND YOUNG STOCK.

Handling and feeding calves.—Among dairy cattle the best practice is to remove the calf from the cow within twenty-four hours after its birth and at once teach it to drink. This separation may be delayed until the dam's milk assumes the normal condition, but as a rule the earlier the calf is taken in hand and its feeding regulated the better for the calf. The younger it is the easier it learns to drink. It is also better for the dairy cow to be regularly milked by hand than to suckle a calf. The milk of good cows is often too rich for their calves, and the latter are apt to take too much if left to help themselves. The calf should have the milk of its dam or some other fresh cow, and receive it while warm, and at least three times a day (preferably four) for a week or more. During this time, if the milk is rich, it should be diluted with warm water one-fifth to one-third its own bulk, according to the richness, or the milk may be kept a few hours, the best of the cream removed, and then warmed and fed. To make a good calf, three feedings a day should be kept up for a month or six weeks, and the milk should be fed warm for a longer period, especially if the weather is cold. But after ten days or so milk set twelve hours and lightly skimmed will do, and after ten days more the skimming may be gradually made closer, until at the end of a month, or soon after, a skim-milk diet is reached. No rule can be given for quantity in feeding calves, they differ so much in size and food requirements. Judgment must be used, the feeding effects observed, and the calf given enough to thrive and be active, but not too much. More calves suffer from overfeeding than from scant diet. Keep the calf a little hungry and eager for more rather than fill it to dullness. The endeavor should be to prevent the beginning of indigestion, which leads to scouring and perhaps fatal diarrhea. Nothing causes indigestion sooner than overfeeding or irregularity in the quantity, time, and temperature of the milk, especially while the calf is young; and absolute cleanliness about the feeding vessels is essential, with frequent scalding. If it can with certainty be kept equally clean, some feeding device which compels the calf to suck its milk instead of swallowing rapidly is preferable to the open pail; but, all considered, the latter is usually the best utensil. If gritting the teeth or other symptoms of indigestion

appear, a little lime water in the milk or a little baking soda will usually prove a correction. Keep the calf dry and clean, fairly warm, but in pure air, and allow it to exercise. If its box is small, turn it daily into a covered yard or small paddock. Young calves like company, but if kept together are likely to learn bad sucking habits. Every calf had better have its own box until a month or two old, and then be tied up out of reach of neighbors; but several may exercise together if not turned out until an hour after taking milk.

Feeding hay and grain.—The calf here referred to is not supposed to be for veal, but to be raised for a dairy cow. The foregoing treatment should be accompanied by early lessons inducing it to eat sweet hay and a little grain. The sooner it learns to eat hay or other rough forage and the more it eats, the better; but keep up milk feeding as long as possible, if only once a day. Grain should be used sparingly, oats and bran preferred, perhaps a little linseed, and always to judiciously supplement the other food. Do not turn it onto grass too soon. If a spring calf, carry it over to the second summer without pasturage. A fall calf will be in good shape to get its living from pasture during its first summer.

Fall calves.—Fall calves are generally better cared for, thrive better, and make better cows than those dropped in the spring; another reason for having cows calve in the autumn. The writer feels certain of getting better results, in the end, from raising four calves dropped at the season advised than from five born in the spring, and is inclined to make the comparison stronger.

Feed for young stock.—From the time milk ceases to be the main food of the calf until the heifer drops her first calf (at which time she becomes a cow, if ever, regardless of age) the feeding of the animal should be with a view to nourishment and growth, without accumulation of flesh. When pasturage is good, after the calf is 6 months old, there can be no better food; if grass is short or dry and growth slackens, supplement with clover hay, wheat bran, or oats. At other times let the food be mainly the coarser and more bulky kinds of forage; the digestive apparatus needs to be developed and become accustomed to working up large quantities of food. A big belly may result, but no matter. If accompanied with a well-sprung rib, a strong back and loin, depth of flank, and other marks of constitutional vigor, a big belly is to be desired, indicating capacity as a feeder and user of feeds. Give long forage, fodder, or "roughness" the preference with young stock, and use grain sparingly as needed to balance the ration and promote growth and thrift. A fall calf, well bred and healthfully grown, should "come in" when just about 2 years old, and ought to make a good cow.

ATTENDANCE AND MILKING.

Regularity and cleanliness.—A herd of good dairy cows deserves to have good care, and this can only be insured by having the right kind of attendants. If the owner is unable to either attend the cows himself or give the matter personal supervision twice a day or more, it is to his interest and profit to be certain that his employees are trustworthy and fit to be cow keepers. Everyone should be quiet, even-tempered, gentle, and regular and cleanly in his habits. A cow abominates an unclean man. Tobacco in all its forms is obnoxious to every department of dairying. All the work about the herd should be done with the utmost system and regularity—stable cleaning, grooming, exercise, watering, feeding, milking; a fixed time for everything and everything at its time—“on the dot.”

Milking.—Nothing has been produced which begins to compare with the human hand as a milking machine. Cleanliness and regularity are the first requisites in good milking. Next, quiet and gentleness should be accompanied by quickness. Two milkers, one rapid and the other slow (the cow being accustomed to both), will get about the same quantity of milk in any given number of days, but the former will get the more fat. The quicker the milking the richer the milk, if the work is done well and completely; the difference may not be great, but it is measurable in butter or money. Again, two men milking like quantities in like time, from the same cows or animals, giving milk usually just alike, will get different results as to richness, and if they change places the richer milk is secured by the same man. The milk fat or butter fat comes from the cow, but it is the expert milker that gets the most of it. There seems to be an undefined and yet conclusively proved relation between some milkers and the cows they handle which produces this result. It is certain that change of milkers, manner or time of milking, irregularity, or any disturbance at milking time, may be expected to cause loss of butter fat in the milk. In short, it pays, and pays well, to have milking done in the very best way, by the very best milkers that can be found. A superior milker should be appreciated and retained as persistently as a superior cow; the former is the more difficult to replace.

Odors in milk.—A very good practice, although uncommon, is to take every cow to a particular place to be milked, apart from where she usually stands; this to be a clean and airy place, like an open shed. The milking shed or room being kept scrupulously clean, with free movement of pure air, there is an almost certain exemption from what are usually called “animal odors” in milk, but which really are stable odors or odors from the milker. It may be stated as a fact, and should always be remembered, that milk as it comes from the healthy cow is perfectly pure. It has by nature no unpleasant taste or smell (except

an occasional result of peculiar food), and all those odors and flavors which are often so objectionable get into the milk after it is drawn from the udder of the cow. They come from the uncleared body of the cow herself or from her surroundings, the air of the stable, the milk vessel, or the clothing or person of the milker. These troubles are all avoidable; they are not to be charged to the cow, but to the man, her keeper.

Milking at short intervals.—With the exception of some extraordinarily large milkers, or for short periods when the yield is largest, there is no gain in milking cows more than twice a day. Within limits, it is true that, if properly done, the oftener a cow is milked the richer will be the milk; but the difference is very slight, and seldom, if ever, enough to pay for the extra labor. In one of the most noted and fully authenticated cases of immense milk production by one cow (a ton or more of milk a month for a year) the cow was milked every six hours for three hundred and sixty-five days, every time by the same man, and always within two minutes of the right hour. This remarkable record was without doubt largely due to the milker, who was the feeder of the cow as well; indeed, the year's performance by the man was as noteworthy as that of the cow.

THE PASTURE SEASON AND SOILING.

Pasturage.—As soon as the spring grass gets high enough for the cows to get a bite, let them have it. At first the time daily on pasture should be very short, for the good of both pasture and cow. The latter should be gradually changed from stable feeding to pasturage, especially if the feeding has been of dry material or mostly so. And the stable feeding should continue unchanged, undiminished, until the cow herself indicates that she is getting enough grass to replace a part of the stable ration. Then, as the pasturage improves, indoor feeding may be lessened and finally discontinued. If a pasture furnishes an abundance and variety of grasses, there can be no better food found for the milch cow. The nutritive ratio for mixed pasturage is about 1 to 5, which can not be improved for succulent food. But the best of pasture grasses contain from 65 to 75 per cent of water, sometimes more, and the cow must procure a large quantity of this material, 100 pounds or so in the course of a day, to secure the food material required. Shade and water should be carefully looked after in connection with pasturage, as well as the grass. In very large pastures there should be watering places in different parts of the inclosure, as well as shade, that the cows may not be compelled to travel far to find either.

Flies.—Until flies become troublesome, cows had better stay in pasture by day and in stable by night, or be left out all the time. But in the worst fly time, and perhaps when the sun's heat is greatest, it is good

practice to stable the herd during the day in an airy but shaded cow-house, and turn it on pasture at night. If the pasture has not abundant shade and water this course should certainly be followed. Heat and flies reduce both quality and quantity of milk product. The trouble from flies can be largely remedied by spraying the cows with a very weak mixture of water and some one of the approved sheep-dip preparations. Such a spraying will last a week or ten days, unless there are hard rains meanwhile. The entire interior of the cow house should be sprayed with a solution of this kind, and strong enough for an insecticide, weekly, throughout the summer.

Feeding grain with pasture.—There is ample evidence that, although milk yield may be increased by feeding grain to cows on good pasture, the gain no more than pays for the extra food, and seldom does that. There may be in some cases a small margin for profit in improving the pastures by less grazing and richer manure. But if pasturage is short, even temporarily deficient, the cows should be fed enough of grain, hay, silage, or green forage to supply the deficiency.

The dairyman who has most of his cows dry during drought, fly time, and “dog days” appreciates the advantages of “bringing in” his cows in the fall.

Soiling.—The advantages of soiling over pasturage are so great, especially where dairying on high-priced land, that every dairyman should carefully study the question of adopting this system. Much depends upon the supply, character, and cost of labor at one's command. It may be profitable to practice partial soiling where it will not be to do more. Careful trials have shown that by feeding cows wholly on green forage crops in the stable from two to five times as much milk can be produced from an acre as from pasturing the same land. Of course farms often contain many acres of pasture land that can not be tilled, but for tillable land the profit in soiling is great. Many more cows can be kept on a given area and the productive capacity of the land can be rapidly increased. The saving of manure and its application to best advantage is one of the great gains in soiling.

Crops for soiling.—For this system of feeding stock a variety of green crops is necessary, grown so as to come to best feeding condition in well-arranged succession throughout the growing season. There must be no breaks; the supply must be certain and sufficient. It is well to aim to grow about twice as much of every crop as one expects to use; any surplus can be saved by drying or putting in a silo. Crops well adapted to soiling in most parts of the country are these: Red clover and timothy, sown separately in July and August; crimson clover and barley, sown in August and September; and wheat and rye, sown in September and October—all these for use in (an open) winter and early spring. Oats, spring barley, and peas sown early in the

spring; vetches, also corn and soy beans, planted or sown in May; cowpeas, corn, millets, and Hungarian grass, sown in June—these for cutting in the summer and fall. The first and second crops from the regular mowing lands of grass and clover will fill in the gaps.

A good deal of skillful management is needed to bring on the crops at the right time in proper succession and in sufficient quantity. At least 110 pounds of green forage should be provided daily, on the average, for every 1,000 pounds' weight of cow; the quantity will vary much with the character of crop. By the soiling system, well managed, 1 acre may feed two cows for five or six months, and 3 acres for five cows is a conservative estimate.

One of the points of gain by soiling is saving the food expended by the animal in its exertion to procure its food at pasture. But moderate exercise should accompany soiling, and a small pasture lot or large paddock should be provided convenient to the cow house for use of the herd, especially at night.

THE STABLING SEASON.

Change from pasture to stable.—Up to a certain point fall pasturage is as good as in any other part of the year. But after one or two hard frosts it is well to offer the cows some nice hay when they come in at night, and if they eat it with relish, one may be pretty certain the season has arrived to gradually change the herd from pasture to stable for the winter. The cows should not be left out at night after it becomes chilly, or be exposed to cold autumn storms. They may be allowed in the field a few hours on all pleasant days until snow flies, but without expecting them to get much besides water and exercise. Before keeping them steadily at the stable and yards the feeding should be, by gradual steps, completely changed to the full stable diet.

Preparation of the stable.—Meanwhile, or on leisure days earlier in the year, the cow house should be prepared for its occupancy by the herd throughout the stabling season. Boxes, stalls, and feeding troughs or floor should be thoroughly cleaned and disinfected, so that no animal can discover or be subjected to any unpleasant traces of another and previous occupant of the place. Then assign every cow her particular place for the winter, and gently insist upon every one being always in the right place. The bedding, absorbents, and disinfectants should be provided in abundance and in ample time for all to be quite dry. Use no damp material under a cow, no rotten straw, and no moist earth or sawdust. In order of efficiency, the best absorbents are peat, spent tanbark, sawdust, wheat straw, forest leaves, and dry earth. If earth alone is used, from 30 to 40 pounds per cow will be needed daily—a big shovelful. If straw alone, pro-

vide 9 or 10 pounds a day, and less if cut short. A good combination is 5 or 6 pounds of straw and 10 or 12 of earth or sawdust. An excess of bedding or litter is undesirable. If the floor on which the cow lies is dry and not cold, very little litter is needed for true bedding. Its chief use is as an absorbent, and if more than necessary for this object is used, the manure becomes too dry and bulky, and is lessened in value per load. Land plaster is a very satisfactory disinfectant or deodorizer about a cow house. If one takes good care of the manure and intends to add chemical fertilizer, the latter may be used in the stable in some forms, instead of plaster. A refuse of the "double phosphate" works is an article called phospho-plaster. This can often be got at about the same price as common plaster, and as it contains about 1 per cent of phosphoric acid, it is a good addition to the stable manure, while also an efficient disinfectant. Kainit, about the lowest grade of German potash salt, is a good substitute for plaster in the stable. It costs half as much again, sometimes twice as much, but less of it may be used, and the potash it contains (11 to 13 per cent) is a very desirable addition to the manure in several ways. From 1 to 2 pounds of kainit or plaster per day to each cow can be profitably used, scattered in the litter and along the gutters of the cow-house throughout the stabling season.

Watering.—It is a mistake to be satisfied with watering the herd but once a day. If they can be induced to drink twice or three times a day, it should be done. Cows need much water. It has been found that the average milch cow requires about 81 pounds of water a day while in milk (nearly 10 gallons), and about 53 pounds while dry. Of this, the cow in milk takes rather more than two-thirds (say 7 gallons) as drink, and the rest in her food, while the dry cow takes rather less than two-thirds as drink, and a little more than one-third in the food.

FEEDING THE HERD.

Uniformity in feeding.—The first advice is not to feed the herd as a herd. Cows differ in their tastes and in their requirements in the way of food just as human beings do, although, perhaps, not to the same extent. To feed all the cows in a herd alike, day after day and month after month, as is so often done, is an absurd and wasteful practice. Some are sure not to get enough for greatest profit, and others are likely to get more than they will use to advantage. This as to quantity only; but differences in kind of feed may be equally desirable. In a thorough study and comprehension of the question of feeding lies the greatest opportunity for the exercise of real economy in the management of the dairy herd.

Rational feeding.—Scientific feeding means simply rational feeding, a common-sense application of a good understanding of the objects of

feeding, the character of food materials, their proper relations, combinations and effects, and the needs and characteristics of the animals in hand. The principles of scientific feeding, the composition and digestibility of feeding stuffs, the food requirements of animals for various purposes, and the calculation of rations, have been explained in *Farmers' Bulletin*, No. 22, issued by the Department of Agriculture. The composition of a large variety of feeding stuffs grown and employed in this country is given in the appendix to the *Department Yearbook*, 1896. To these, therefore, the student of the great feeding problem is referred, as that is much too big a subject to discuss in detail here.

Measures and weights of feeds.—In practice it is more common and convenient to measure grain food than to weigh it when mixing rations for cows. Yet one may want to keep weights in mind at the same time. For this purpose the following little table is handy and approximately correct:

Grain foods—relations of weights and measures.

Food stuff.	Half bushel weighs—		Food stuff.	Half bushel weighs—	
	Pounds.	Lbs. Oz.		Pounds.	Lbs. Oz.
Wheat, whole	30	1 14	Corn and cob meal	22	1 6
Cracked corn.....	28	1 12	Wheat middlings.....	18	1 2
Gluten meal.....	26	1 8	Oats, whole.....	16	1 0
Cotton-seed meal.....	25½	1 9	Ground oats	12	0 12
Corn meal.....	23½	1 7	Wheat bran.....	10	0 10

Some of the articles named are quite variable in weight, however, wheat bran, especially, and weighing is always the safer way. No cow-house is properly equipped without its scales for weighing feed stuffs and milk, and its book, paper, or slate, with pencil, for making notes and records in connection with the feeding, the milk product, and all facts of interest and desirable for preservation.

GENERAL NOTES.

There are various other questions which arise in the consideration of the problem of feeding the dairy herd which have not been touched upon, and but a part of which can even be mentioned here. On the practical side, one should ascertain the kind and quantity of feeding stuffs which have been produced and are available on the farm, the best way of preparing these for the cattle, and the matter of markets in its relation to getting those articles which it seems desirable to buy in order to supplement the home supplies and balance the rations. On the scientific side there are a good many additional points which deserve careful attention, such as the relations of breed and feed in the

economy of dairy practice; the effects of different foods upon the production of milk and butter, in quantity and in quality, having the item of flavor prominent; effects of food upon the economy of churning or "the churnability" of the cream; and the comparatively new subject of bacteriology in its bearings on dairying, the health and cleanliness of the cow-house, and the preservation of products.

The whole subject of animal nutrition is under investigation and discussion, and by watching the publications of American experiment stations and the reviews of foreign work new suggestions of practical application will be found appearing at intervals.

The manure from a well-fed dairy herd is a matter of great consequence, and its proper management requires judgment. The better the feeding the better the manure. While all manure is worth good care, the better the manure the more important it is to handle it well to prevent heavy losses. The best single piece of advice as to handling stable manure is to get it from the stable to the land where wanted without delay and there spread it with the least possible expenditure of labor. Yet this general plan must be modified at times, and according to circumstances.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number and title of each. Copies will be sent to any address on application to any Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C.:

No. 22. The Feeding of Farm Animals. No. 24. Hog Cholera and Swine Plague. No. 25. Peanuts: Culture and Uses. No. 27. Flax for Seed and Fiber. No. 28. Weeds: And How to Kill Them. No. 29. Souring and Other Changes in Milk. No. 30. Grape Diseases on the Pacific Coast. No. 32. Silos and Silage. No. 33. Peach Growing for Market. No. 34. Meats: Composition and Cooking. No. 35. Potato Culture. No. 36. Cotton Seed and Its Products. No. 37. Kafir Corn: Culture and Uses. No. 39. Onion Culture. No. 41. Fowls: Care and Feeding. No. 42. Facts About Milk. No. 43. Sewage Disposal on the Farm. No. 44. Commercial Fertilizers. No. 46. Irrigation in Humid Climates. No. 47. Insects Affecting the Cotton Plant. No. 48. The Manuring of Cotton. No. 49. Sheep Feeding. No. 51. Standard Varieties of Chickens. No. 52. The Sugar Beet. No. 54. Some Common Birds. No. 55. The Dairy Herd. No. 56. Experiment Station Work—I. No. 58. The Soy Bean as a Forage Crop. No. 59. Bee Keeping. No. 60. Methods of Curing Tobacco. No. 61. Asparagus Culture. No. 62. Marketing Farm Produce. No. 64. Ducks and Geese. No. 65. Experiment Station Work—II. No. 66. Meadows and Pastures. No. 68. The Black Rot of the Cabbage. No. 69. Experiment Station Work—III. No. 70. Insect Enemies of the Grape. No. 71. Essential in Beef Production. No. 72. Cattle Ranges of the Southwest. No. 73. Experiment Station Work—IV. No. 74. Milk as Food. No. 77. The Liming of Soils. No. 78. Experiment Station Work—V. No. 79. Experiment Station Work—VI. No. 80. The Peach Twig-borer. No. 81. Corn Culture in the South. No. 82. The Culture of Tobacco. No. 83. Tobacco Soils. No. 84. Experiment Station Work—VII. No. 85. Fish as Food. No. 86. Thirty Poisonous Plants. No. 87. Experiment Station Work—VIII. No. 88. Alkali Lands. No. 91. Potato Diseases and Treatment. No. 92. Experiment Station Work—IX. No. 93. Sugar as Food. No. 95. Good Roads for Farmers. No. 96. Raising Sheep for Mutton. No. 97. Experiment Station Work—X. 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